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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/704,176	10/31/2000	Blaine D Gaither	10007099-1	2685

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EXAMINER
ELMORE, STEPHEN C

ART UNIT	PAPER NUMBER
2186	

DATE MAILED: 06/23/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
Office Action Summary	09/704,176	GAITHER ET AL.
	Examiner	Art Unit
	Stephen Elmore	2186

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on _29 April 2004_.
2a) ☐ This action is **FINAL**.   2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) _1,2,4-6,11 and 12_ is/are pending in the application.
    4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☒ Claim(s) _12_ is/are allowed.
6) ☒ Claim(s) _1,2 and 4-6_ is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.
10) ☒ The drawing(s) filed on _October 22, 2003_ is/are: a)☐ accepted or b)☒ objected to by the Examiner.
    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
    a)☐ All   b)☐ Some * c)☐ None of:
      1.☐ Certified copies of the priority documents have been received.
      2.☐ Certified copies of the priority documents have been received in Application No. _____.
      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1.   This Office action responds to the Appeal Brief, filed 29 April 2004, in which arguments presented in response to the Final Office action, 29 January 2004, having been persuasive, therefore, the finality of that action is **withdrawn,** and the status of the claims remaining in the present application are as discussed hereafter.

2.   Claims 1, 2, 4-6, 11 and 12 remain for examination.

Drawings

3.   The paper filed 28 April 2004 and titled "Petition To Accept Drawings (37 CFR 1.182)" has been treated as a request for consideration in respect to the examiner's objection to the drawings to show the claimed method steps of claims 11 and 12. The objection to the drawings is **withdrawn,** however, the following new objection is made.

4.   The drawings are newly objected to because in Fig. 5, the description in the drawing which states,

"contains an address reference (which may be a tag) for every line in the caches for which a corresponding line may not be identical"

is unclear in meaning due to the use of the "may (emphasis added) not be identical" language.

The uncertain scope of meaning covered by the use of the "may not be" language makes the descriptive content of the drawing vague and indefinite, since it is not clear what scope of meaning "may not be" represents.

Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

5. The rejections of claims 11 and 12 under 35 USC 112, first paragraph, are **withdrawn**.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1-6 are newly rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The claims are indefinite because:

a. in claim 1, the scope of meaning of the following limitation is unclear,

"a list containing: an address reference for every line in the plurality of memory caches for which a corresponding line in memory may not be (emphasis added) *identical"* because this language states that the status of a line in the plurality of memory caches <u>may</u> not be identical, therefore, this language implies that the status of the line is indefinite since the scope of meaning of the term "may" is indefinite. The language "may not be identical" discusses memory coherency in the computer system when it refers to the state "identical" in regard to the status of a line in a memory cache corresponding to a line in system memory, and this is indefinite because system coherency teaches that, based on the system's cache coherency policy, a line either <u>is identical</u> (i.e., coherent) or it <u>is not identical</u> (i.e., not coherent), since an indeterminate state (such as is implied by use of "may") is not permitted by the coherency policy. A line's state or status has to be maintained in a known state, otherwise the validity or coherency of data in a system cannot be assured, and the system cache coherency policy enforces this requirement. In order for memory coherency to maintain the validity of data in a computer system, a computer system's cache coherence policy does not permit indeterminate states for the lines having corresponding lines in system memory, such as the indeterminate state that the scope of the language "may not be identical" covers, therefore, the limitation is indefinite in scope because it uses the language "<u>may</u> not be identical".

However, in order to further prosecution for the purpose of applying prior art, and giving this language the best interpretation possible under these circumstances, the above limitation will hereafter be interpreted as if it were to read,

"a list containing: an address reference for every line in the plurality of memory caches for which a corresponding line in memory is not identical"

wherefor, support for this interpretation is found in the specification, at page 7, lines 3-14, which teaches that "the computer system may maintain a list of all lines in the system having a state of "exclusive" or "modified" (that is, interpreted to teach that, by application of the system coherency policy, the corresponding line in memory is not identical to the line in cache) and a prior art reference meeting this limitation would teach a list containing all lines in the system having a state of "exclusive" or "modified" under the coherency policy;

    b.   in dependent claim 4, the language,

"wherein the number of address references that the list can hold is substantially less than the total number of lines that can be stored in the plurality of memory caches"

is indefinite because the term "substantially" is an indefinite quantity, making this limitation's metes and bounds unclear to one of ordinary skill because this language does not teach one of ordinary skill the specific quantity that <u>how much</u> less "substantially" represented, because it is broad;

    Note: The term "substantially" is often used in conjunction with another term to describe a particular characteristic of the claimed invention. It is a broad term. *In re Nehrenberg*, 280 F.2d 161, 126 USPQ 383 (CCPA 1960).

    c.   claims 2 and 4-6 inherit the deficiency of the independent claim from which they depend.

Claim Rejections - 35 USC § 102

8.   The rejections of claims 1 and 5 under 35 USC 102(b), <u>Cheng et al.</u>, US Patent 5,655,103 are **withdrawn**, however, the following new rejections are made.

9.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10.   Claims 1, 2, 4 and 5 are rejected under 35 U.S.C. 102(e) as being anticipated by <u>Sharma</u>

<u>et al.</u>, US 2003/0009638 A1, as supported by the extrinsic definition of the cache terminology

term "tag," as taught in the Glossary of the book "The Cache Memory Book," Second Edition,

Jim Handy, Glossary, "Tag" definition, page 220, 1998.

Sharma teaches the present invention (claim 1) as claimed comprising:

a.   the limitation, a plurality of memory caches is taught, as memory caches 111 and

121 of processors 110 and 120, see Fig. 1;

b.   a list containing; an address reference for every line in the plurality of memory

caches for which a corresponding line in memory may not be identical, this limitation is

interpreted as (as indicated in para. 7.a. above) the limitation, for which a corresponding line in

memory is not identical, and an indicator of which cache owns each line, these limitations are

taught by Sharma as a list containing some of the elements of the centralized cache coherency

directory 102, see para [0023], specifically, taught as elements of the column labeled "owner"

taken together with elements of the column labeled "segment address," for the scope of states M

and E only, which two elements together form a list representing every line in the plurality of

memory caches for which a corresponding line in memory is not identical, i.e., states M and E, as

shown in Fig. 1;

c.   and the limitations, the list not containing; address references for lines that are shared or uncached; and data corresponding to the address references, Sharma teaches these limitations because the list as described above does not contain address references for shared or uncached lines, and the list does not contain data corresponding to the address references;

As to claim 2,

d.   Sharma inherently teaches the limitation wherein the address reference is a tag, giving Sharma's cache coherence directory 102 "Segment address" the interpretation that it represents an address reference of a line in cache memory corresponding to a line in system, or main, memory, that is equivalent to the accepted meaning of the cache memory term "tag" as defined in Handy's Glossary, the definition of "tag" teaching that the address reference of a line in a cache memory, which line is represented in a cache directory, corresponds to a line location in main memory whose line address is equivalent to a tag in the cache directory, since the tag address matches the address of the contents of the main memory location being accessed in Sharma's cache coherence directory;

As to claim 4,

e.   Sharma inherently teaches the limitation, wherein the number of address references that the list can hold is substantially less (giving this limitation the best possible interpretation given the 112, second paragraph problem mentioned above over the use of "substantially"), this limitation will be interpreted as if it read that the number of address references the list can hold is less than the total number of lines that can be stored in the plurality of memory caches, and the teaching of the list as interpreted in Sharma, as noted by the combination of elements of the list in the "ownership" and "segment address" for states M and E,

the number of address references in this list is quantifiably less that the total number of lines that can be stored in the plurality of memory caches, because as shown in the cache coherency directory 102 there exists more lines in the caches than are contained in the list as taught as above described in para. b, above;

As to claim 5,

f.   Sharma teaches that the list comprises a single list shared by all the devices in the computer system because the list, as noted above, is a shared list, being part of a centralized cache coherency directory 102.

Claim Rejections - 35 USC § 103

11.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

12.   Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over <u>Sharma et al.</u>, US 2003/0009638 A1 further in view of <u>Islam et al.</u>, US Patent 6,490,625.

Sharma teaches the claimed invention (claim 11) of a method for maintaining cache coherency in a computer system, comprising:

a.   the limitation, entering into a list, an address reference for all lines that are owned, is taught, see Fig. 1, and para. [0023], taught as a list formed of the elements "owned lines," (0 or 1) and "segment address" of each owned line which are elements forming only a portion of the centralized cache coherency directory 102 but whose specific elements do teach the claimed list to the extent they are claimed;

b.   the limitation, not entering into the list address references for lines that are shared or uncached, and updating the list only when ownership of a line changes, this limitation is taught by the teaching of the specific elements of the list as noted above, because this list does not contain lines that are shared or uncached, and this list is updated only when ownership changes, see Fig. 1, portion of element 102, and see para. [0023], and see Table 1, wherein only in certain contents of the table, this list is updated only when ownership updates the list formed of that portion of the centralized cache coherency directory which forms a list of elements of ownership being 0 or 1, in the ownership column;

c.   however, Sharma does not teach the limitation, removing an address reference to a line, from the list, when the line has remained in the list for longer than a specified time, but Islam teaches that it is old and well-known in the art of cache line, i.e., cache item, management, the feature to remove items from a cache by using an expiration time, see col. 11, lines 30-36, applied to a miss server incorporating such a cache line replacement mechanism, that is, items (or cache lines) whose expiration times have passed are removed, see Abstract, and see Fig. 3, item cache 320, and cache lines, i.e., items 1, 2, 3, etc., as elements 323 of Fig. 3, and it would

have been obvious to one of ordinary skill in the art at the time the invention was made to modify Sharma to incorporate the feature, to remove items in the list whose expiration time had passed (i.e., the expiry time) because, as suggested by Islam, see col. 2, lines 24-35, for the benefits provided to a server architecture system which incorporates such a feature, which benefits includes improved performance, throughput rates, flexibility, item consistency and scalability.

Response to Arguments

13.   Applicant's arguments filed in the Appeal Brief, filed 29 April 2004, in response to the Final Office action were fully considered and persuasive, resulting in the present Office action.

Allowable Subject Matter

14.   Claim 12 is allowable over the prior art of record because the limitations,

updating the list only when ownership of a line changes in combination with removing an address reference to a line, from the list, even when the list is not full, to help prevent the list from filling,

such limitations taken in combination with the remaining limitations are not found in, and or are not obvious in view of, the prior art of record.

15.   Claim 6 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Conclusion

16.   The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure.

Passint et al., US 6,633,958 teaches that it is old and well-known in the art to reduce the

size of the cache directory, and also teaches that it is old and well-known in the art for coherence

directories to include a tag as an address reference to a corresponding line in main memory.

Hoover et al., US 5,749,087 958 teaches that it is old and well-known in the art for

coherence directories to include a tag as an address reference to a corresponding line in main

memory.

17.   Any inquiry concerning this communication or earlier communications from the
examiner should be directed to Stephen Elmore whose telephone number is (703) 308-6256. The
examiner can normally be reached on Mon-Fri from 7:30-4:00.

       If attempts to reach the examiner by telephone are unsuccessful, the examiner's
supervisor, Matthew Kim can be reached on (703) 305-3821. The fax phone number for the
organization where this application or proceeding is assigned is 703-872-9306.

       Information regarding the status of an application may be obtained from the Patent
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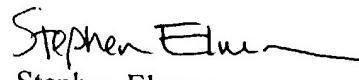
Stephen Elmore
Patent Examiner
Art Unit 2186

June 21, 2004